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Date: January 30, 2007

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.:	10/689,390
Applicant:	BEAUMONT, Mark
Filed:	20 October 2003
Title:	Method of Rotating Data in a Plurality of Processing Elements
Art Unit:	2183
Examiner:	PETRANEK, Jacob A.
Docket No.:	PAT001063-000

APPELLANT'S BRIEF ON APPEAL UNDER 37 C.F.R. § 41.37

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Sir:

This Appeal Brief is in support of Appellant's "Notice of Appeal from the Examiner to the Board of Patent Appeals and Interferences" mailed on November 9, 2006, and is pursuant to 37 C.F.R. § 41.37.

(i) REAL PARTY IN INTEREST

The real party in interest in this case is Micron Technology, Inc., the assignee of the entire interest of the above-identified patent application.

(ii) RELATED APPEALS AND INTERFERENCES

There are no known prior and pending appeals, interferences, or judicial proceedings which may be related to, directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(iii) STATUS OF CLAIMS

The application was originally filed with claims 1-36, all of which have been finally rejected in the Final Office Action mailed on August 23, 2006. The rejection of all claims 1-36 is appealed herein. The claims, as they presently stand, are found in the Claims Appendix to this Appellant's Appeal Brief.

(iv) STATUS OF AMENDMENTS

The sole After Final Amendment was mailed on October 6, 2006 and has been entered for purposes of appeal. No claim amendments were made in the After Final Amendment.

(v) SUMMARY OF CLAIMED SUBJECT MATTER

Independent method claim 1 is drawn to a method of rotating data in a plurality of processing elements (figure 2, Ref. No. 36, page 6, paragraphs 39-40, figure 3, Ref. No. 37, page 6, paragraphs 41-43, figure 5, Ref. No. 36, and page 8, paragraphs 49-51) comprising a plurality of shifting operations performed by a plurality of processing elements connected in an array (figures 6A-10B and pages 8-9, paragraphs 51-54), a plurality of storing operations performed by said plurality of processing elements (page 11, paragraphs 63 and 64), said shifting and storing operations coordinated to enable a three shears operation to be performed on the data (figures 15A-15D, 16A-16D and pages 12-14, paragraphs 68-75), and wherein said plurality of storing operations is responsive to each processing element's position in said array (pages 12-14, paragraph 68-75).

Independent method claim 8 is drawn to a method of rotating data in a plurality of processing elements (figure 2, Ref. No. 36, page 6, paragraphs 39-40, figure 3, Ref. No. 37,

page 6, paragraphs 41-43, figure 5, Ref. No. 36, and page 8, paragraphs 49-51) comprising a first shifting of a first plurality of data in a first direction (e.g., east) and a first storing of data by a first plurality of said processing elements in response to said first shifting and the positions of said first plurality of processing elements (figures 15A-15B and page 12, paragraph 68), a second shifting of a second plurality of data in a second direction perpendicular to said first direction (e.g., south) and a second storing of data by a second plurality of processing elements in response to said second shifting and the positions of said second plurality of processing elements (figures 15B-15C and page 13, paragraph 69), a third shifting of a third plurality of data in a third direction opposite to said first direction (e.g., west) and a third storing of data by a third plurality of processing elements in response to said third shifting and the positions of said third plurality of processing elements (figures 15C-15D and page 13, paragraph 70).

Independent method claim 15 is drawn to a method of rotating data in a plurality of processing elements (figure 2, Ref. No. 36, page 6, paragraphs 39-40, figure 3, Ref. No. 37, page 6, paragraphs 41-43, figure 5, Ref. No. 36, and page 8, paragraphs 49-51) comprising a first plurality of shifting and storing operations coordinated to enable a first shear operation to be performed in a first direction (e.g., east) in a plurality of processing elements arranged in an array (figures 15A-15B and page 12, paragraph 68), a second plurality of shifting and storing operations coordinated to enable a second shear operation to be performed in a second direction perpendicular to said first direction (e.g., south) in said array (figures 15B-15C and page 13, paragraph 69), a third plurality of shifting and storing operations coordinated to enable a third shear operation to be performed in a third direction opposite to said first direction (e.g., west) in said array (figures 15C-15D and page 13, paragraph 70), and wherein said pluralities of storing operations are responsive to each processing element's position in said array (page 14, paragraph 75).

Independent method claim 22 is drawn to a method of rotating data in a plurality of processing elements (figure 2, Ref. No. 36, page 6, paragraphs 39-40, figure 3, Ref. No. 37, page 6, paragraphs 41-43, figure 5, Ref. No. 36, and page 8, paragraphs 49-51) comprising a first shifting of a first plurality of data in a first pair of directions (e.g., east, west) and a first storing of data by a first plurality of said processing elements in response to said first shifting and the positions of said first plurality of processing elements (figures 16A-16B and page 13, paragraph 72), a second shifting of a second plurality of data in a second pair of directions

perpendicular to said first pair of directions (e.g., north, south) and a second storing of data by a second plurality of processing elements in response to said second shifting and the positions of said second plurality of processing elements (figures 16B-16C and page 14, paragraph 73), a third shifting of a third plurality of data in said first pair of directions (e.g., east, west) and a third storing of data by a third plurality of processing elements in response to said third shifting and the positions of said third plurality of processing elements (figures 16C-16D and page 14, paragraph 74).

Independent method claim 29 is drawn to a method of rotating data in a plurality of processing elements (figure 2, Ref. No. 36, page 6, paragraphs 39-40, figure 3, Ref. No. 37, page 6, paragraphs 41-43, figure 5, Ref. No. 36, and page 8, paragraphs 49-51) comprising a first plurality of shifting and storing operations coordinated to enable a first shear operation to be performed in a first pair of directions (e.g., east, west) in a plurality of processing elements arranged in an array (figures 16A-16B and page 13, paragraph 72), a second plurality of shifting and storing operations coordinated to enable a second shear operation to be performed in a second pair of directions perpendicular to said first pair of directions (e.g., north, south) in said array (figures 16B-16C and page 14, paragraph 73), and a third plurality of shifting and storing operations coordinated to enable a third shear operation to be performed in said first pair of directions (e.g., east, west), and wherein said pluralities of storing operations are responsive to each element's position in said array (figures 16C-16D, and page 14, paragraph 74).

Independent claim 36 is drawn to a computer readable memory device carrying a set of instructions which, when executed, perform a method comprising a plurality of shifting operations (figures 6A-10B and pages 8-9, paragraphs 51-54) using a plurality of processing elements connected in an array (figure 2, Ref. No. 36, page 6, paragraphs 39-40, figure 3, Ref. No. 37, page 6, paragraphs 41-43, figure 5, Ref. No. 36, and page 8, paragraphs 49-51), a plurality of storing operations using said plurality of processing elements (page 11, paragraphs 63 and 64), said shifting and storing operations coordinated to enable a three shears operation to be performed on the data, and wherein said plurality of storing operations is responsive to each processing element's position in said array (figures 15A-15D, 16A-16D and pages 12-14, paragraphs 68-75).

(vi) GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A. Claims 1-6, 8-13, 15-20, 22-27, 29-34, and 36 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Crozier (US 5,081,700), in view of Pechanek et al. (US 6,338,129).

B. Claims 7, 14, 21, 28, and 35 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Crozier (US 5,081,700), in view of Pechanek et al. (US 6,338,129), further in view of Taylor (US 4,992,933).

(vii) ARGUMENT

A. Claims 1-6, 8-13, 15-20, 22-27, 29-34, and 36 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Crozier (US 5,081,700), in view of Pechanek et al. (US 6,338,129).

1. The rejection of claims 1-6, 8-13, 15-20, 22-27, 29-34, and 36 under 35 U.S.C. § 103(a) over Crozier in view of Pechanek must be reversed because the Office used an incorrect legal standard.

The appellant respectfully submits that the Office's rejection of claims 1-6, 8-13, 15-20, 22-27, 29-34, and 36 under 35 U.S.C. § 103(a) as being unpatentable over Crozier (US 5,081,700), in view of Pechanek et al. (US 6,338,129) is improper because this rejection fails to apply the correct legal standard with regard to rejections made under 35 U.S.C. § 103. The determination of patentability is based on the legal standard of "a preponderance of evidence." For a rejection under 35 U.S.C. § 103, the examiner must provide evidence which as a whole shows that the legal determination sought to be proved (i.e., the reference teachings establish a *prima facie* case of obviousness) is more probable than not. See MPEP 2142. The Office erred in the rejection of claims 1-6 because the Office applied a "could be" standard rather than the correct legal standard of more probable than not. Application of this "could be" standard is seen on page 4, paragraph 10, and pages 6-7, paragraph 16, of the Final Office Action in which the Office states "Pechanek disclosed a plurality of processing elements that the image rotation method of Crozier could be done on." Thus, it is shown that the Office's rejection of independent claims 1, 8, 15, 22, 29, and 36 and dependent claims 2-6, 9-13, 16-20, 23-27, and 30-34 under 35 U.S.C. § 103 is based on the standard that the image rotation method of Crozier "could be" performed on the structure of Pechanek and not the correct legal standard of more probable than not, and therefore this rejection is improper.

2. The rejection of claims 1-6, 8-13, 15-20, 22-27, 29-34, and 36 under 35 U.S.C. § 103(a) as being unpatentable over Crozier (US 5,081,700), in view of Pechanek et al. (US 6,338,129) must be reversed because the references do not disclose or suggest all the claim limitations.

The portions of Crozier cited by the Office, figures 5A-5D, and col. 5, lines 39-58, disclose that the rotation hardware shown in figure 2, Ref. No. 20, is able to perform a 90 degree counterclockwise rotation of alphanumeric character data. It is noted that the cited portions of Crozier recite the rotation hardware used for performing the rotation of data, and specifically recite the use of the barrel shifter, see figure 2, Ref. No. 28, and the feedback line, see figure 2, Ref. No. 35. The cited portions of Crozier do not disclose a method for rotation of data separate from the rotation hardware shown in figure 2, Ref. No. 20, and therefore the only method disclosed by Crozier is the inherent method performed by the rotation hardware during normal and usual operation.

Referring to figure 2 of Crazier, the rotation hardware during normal and usual operation receives data read out of a character generator memory (17) in a micro column word format on an input line (18). The rotation hardware then processes the data in micro column word format using a multiplexer (25), that selectively passes the data on the input line (18) or a feedback line (35), a 180 degree multiplexer (27), that selectively inverts the data (col. 3 lines 9-12), a barrel shifter (28) that performs an end around shift on the data one micro column at a time (col. 3, lines 3-6 and lines 12-16), a register array (32) that shifts the data output by the barrel shifter one, two, or three write access times (col. 4, lines 28-48), and rotate RAMS (34), that store the data output from the register array micro column word slice by micro column word slice (col. 3, lines 49-53). The components of the rotation hardware are connected in a feedback loop to perform the rotation of data.

When the rotation hardware performs a 90 degree counterclockwise rotation of an alphanumeric character data matrix, such as that displayed in figures 5A-5D, the alphanumeric character data matrix (figure 5A) must be broken down into micro column words before the data can be processed one micro column word at a time by the components of the rotation hardware. Once the data has been broken down into micro column words, the barrel shifter performs an end around shift on the micro column words one word at a time. After the barrel shifter performs the end around shift on a micro column word, the micro column word is immediately output to the register array where it is linearly shifted. The "barrel shift 1" alphanumeric character data matrix

of figure 5B is not produced in the rotation hardware because the output of the barrel shifter is never stored in the rotation hardware. Instead, the output of the barrel shifter is immediately transmitted to the register array which performs a linear shift. While it is noted that some data output from the barrel shifter is temporally stored in the individual shift registers of the register array, this temporally stored data does not comprise the barrel shift 1 alphanumeric character data matrix of figure 5B because the individual shift registers are connected in a staggered configuration to implement a linear shift and not all data output from the barrel shifter is stored in the individual shift registers. Thus, the barrel shift 1 alphanumeric character data matrix of figure 5B is presented to the reader as a visual aid to assist in understanding the operation of the barrel shifter and is not a matrix of data available in the rotation hardware at some point in time.

After the data has been shifted by the barrel shifter and the register array, the data is then stored in the rotate RAMS, thus producing the linear shift alphanumeric character data matrix (figure 5C) in the rotation hardware. The linear shift alphanumeric character data matrix is then broken down into micro column words and fedback through the barrel shifter one micro column word at a time. The barrel shifter performs a second end around shift on the data one micro column word at a time, and each shifted micro column word is output from the barrel shifter out of the rotation hardware to the bit map memory (22). The "barrel shift 2" alphanumeric character data matrix of figure 5D is not a matrix of data available in the rotation hardware but is available in the bit map memory outside the rotation hardware.

On page 14 of the Final Office Action, the Office admits Crozier does not disclose rotating data in a plurality of processing elements by saying that Crozier is not being relied upon for teaching this particular limitation. The Office then cites Pechanek, figure 1a, col. 1, lines 46-67, and col. 2, lines 1-28, as disclosing a nearest neighbor torus connected computer structure. Pechanek simply discloses that the processing elements in the nearest neighbor torus connected computer "are operated in a synchronous single instruction multiple data (SIMD) fashion" and makes no mention of a method for rotating data in the nearest neighbor torus connected computer. Further, the Office does not rely on Pechanek for disclosing the claimed method of rotating data in a plurality of processing elements. Instead, the Office relies on Pechanek only for the nearest neighbor torus connected computer structure. The Office then attempts to combine the admittedly different inherent method performed by the normal and usual operation

of the rotation hardware of Crozier with the nearest neighbor torus connected computer structure of Pechanek.

a. Independent Claims 1 and 36

Neither of Crozier nor Pechanek discloses a plurality of shifting and storing operations performed by "a plurality of processing elements connected in an array" for performing rotation of data; neither discloses that the storing operations performed during the rotation of data are "responsive to each processing element's position in said array," such as that required by independent claims 1 and 36. The rotation hardware of Crozier is comprised of a multiplexer (25), a 180 degree multiplexer (27), a barrel shifter (28), a register array (22), and rotate RAMS (34) in a feedback loop configuration, and thus, the inherent method performed by the normal and usual operation of the rotation hardware will be significantly different from the method for rotating data in a plurality of processing elements. Pechanek discloses a nearest neighbor torus connected computer and makes no mention of a method for rotating data in the nearest neighbor torus connected computer. Therefore, the rejection under 35 U.S.C. § 103 is improper because Crozier and Pechanek fail to disclose or suggest all the claim limitations of independent claims 1 and 36.

b. Independent Claims 8 and 15

Neither of Crozier nor Pechanek discloses "a first storing of data by a first plurality of said processing elements in response to said first shifting and the positions of said first plurality of processing elements," and "a second storing of data by a second plurality of processing elements in response to said second shifting and the positions of said second plurality of processing elements," and "a third storing of data by a third plurality of processing elements in response to said third shifting and the positions of said third plurality of processing elements," such as that required by independent claims 8 and 15. The rotation hardware of Crozier uses a barrel shifter to perform the first and third shifting operations and a register array to perform the second shifting operation. Neither the barrel shifter nor the register array is structurally similar to a plurality of processing elements, and thus, how shifting operations are performed in the barrel shifter and register array will be significantly different from how shifting operations are performed in a plurality of processing elements. Further, the output of the barrel shifter, which performs the first and third shifting operations, is never stored in the rotation hardware.

Pechanek discloses a nearest neighbor torus connected computer and makes no mention of a method for rotating data in the nearest neighbor torus connected computer. Therefore, the rejection under 35 U.S.C. § 103 is improper because Crozier and Pechanek fail to disclose or suggest all the claim limitations of independent claims 8 and 15.

c. Independent Claims 22 and 29

Neither of Crozier nor Pechanek discloses rotating data by shifting data in a pair of directions or "a first storing of data by a first plurality of said processing elements in response to said first shifting and the positions of said first plurality of processing elements," and "a second storing of data by a second plurality of processing elements in response to said second shifting and the positions of said second plurality of processing elements," and "a third storing of data by a third plurality of processing elements in response to said third shifting and the positions of said third plurality of processing elements," such as that required by independent claims 22 and 29. The rotation hardware of Crozier uses the barrel shifter to perform the first and third shifting operations and a register array to perform the second shifting operation. The barrel shifter can perform only an end around shift of data in one direction for one pass of the entire data matrix in a micro column word format; the register array is comprised of plurality of individual shift registers hardwired in the rotation hardware that can perform only a shift of data in the east direction.

Neither the barrel shifter nor the register array can perform a shift of data in a pair of directions. The Office admits as much on page 10, paragraph 28, of the Final Office Action by stating "Crozier and Pechanek failed to teach first shifting on a plurality of data done in a first pair of directions, second shifting on a plurality of data done in a second pair of directions, and third shifting on a plurality of data done in a third pair of directions." Because rotating data by shifting data in a pair of directions is not carried out by any of the references of record, there must be a further modification performed on the combination of Crozier and Pechanek. This further modification is proposed on page 10, paragraph 28, of the Final Office Action, and it uses the embodiment of the appellant's invention, shown in figures 16A-16D as a blueprint for how to modify Crozier and Pechanek. The reliance on the appellant's disclosure for further modification of Crozier and Pechanek can only have been carried out as a result of improper hindsight reconstruction. Neither the barrel shifter nor the register array is structurally similar to a plurality of processing elements. Thus, how shifting operations are performed in the barrel

shifter and register array will be significantly different from how shifting operations are performed in a plurality of processing elements. Further, the output of the barrel shifter, which performs the first and third shifting operations, is never stored in the rotation hardware. Pechanek discloses a nearest neighbor torus connected computer and makes no mention of a method for rotating data in the nearest neighbor torus connected computer. Therefore, the rejection under 35 U.S.C. § 103 is improper because Crozier and Pechanek fail to disclose or suggest all the claim limitations of independent claims 22 and 29.

3. The rejection of claims 1-6, 8-13, 15-20, 22-27, 29-34, and 36 under 35 U.S.C. § 103(a) as being unpatentable over Crozier (US 5,081,700), in view of Pechanek et al. (US 6,338,129) must be reversed because there is no reasonable expectation of success.

The normal and usual operation of the rotation hardware of Crozier cannot be performed on the significantly different nearest neighbor torus connected computer structure of Pechanek. The inherent method performed by the normal and usual operation of a hardware structure is exclusive to that hardware structure. The rotational hardware of Crozier is comprised of a multiplexer (25), a 180 degree multiplexer (27), a barrel shifter (22), a register array (32), and rotate RAMS (34) in a feedback loop configuration, whereas the nearest neighbor torus connected computer of Pechanek is comprised of multiple processing elements connected to their north, south, east, and west neighbors through torus connection paths. Thus, even when measured by the incorrect legal standard of "could be," the hardware disclosed by Pechanek could not perform the normal and usual operation of Crozier because the normal and usual operation of Crozier will not provide a control scheme for operating the multiple processing elements of Pechanek. The inherent method disclosed by Crozier will be able to be performed only on hardware similar to that disclosed in Crozier with any reasonable expectation of success and will not be able to be performed on the dissimilar hardware of Pechanek. The Office relies on the combination of the normal and usual operation of Crozier with the multiple processing elements of Pechanek in the rejection of all independent claims, and therefore, the above argument is applicable to all independent claims.

4. The rejection of claims 1-6, 8-13, 15-20, 22-27, 29-34, and 36 under 35 U.S.C. § 103(a) as being unpatentable over Crozier (US 5,081,700), in view of Pechanek et al. (US 6,338,129) must be reversed because there is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings.

The Office's attempt to combine references by stating that "Thus, it would have been obvious to one of ordinary skill in the art to implement Crozier's method of image rotation on the parallel processor of Pechanek for the advantage of being able to efficiently process the images," is little more than a broad conclusory statement. This broad conclusory statement fails to point out what specific understanding or technical principle in the references themselves or in the knowledge generally available to one of ordinary skill in the art would have suggested the combination. See page 4, paragraph 10 of the Final Office Action. Further, this broad conclusory statement contradicts the teachings in the references themselves. Pechanek discloses that the nearest neighbor torus connected computer structure shown in figure 1A introduces latency in the communications paths between processing elements, and therefore, the nearest neighbor torus connected computer operates inefficiently. See Pechanek col. 2, lines 46-50. Crozier discloses the rotation hardware efficiently processes images by reducing the character generator memory required for image storage. See Crozier col. 1, lines 39-51. The Office relies on this same broad conclusory statement in the rejection of all independent claims, and therefore, the above argument is applicable to all independent claims.

B. Claims 7, 14, 21, 28, and 35 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Crozier (US 5,081,700), in view of Pechanek et al. (US 6,338,129), further in view of Taylor (US 4,992,933).

Dependent Claims 7, 14, 21, 28, and 35 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Crozier (US 5,081,700), in view of Pechanek et al. (US 6,338,129), further in view of Taylor (US 4,992,933). Appellant submits that the rejections of claims 7, 14, 21, 28, and 35 are improper for at least the reasons discussed above with respect to independent claims 1, 8, 15, 22, and 29.

CONCLUSION

For the foregoing reasons, it is respectfully requested that the rejection of all of the claims be reversed.

Respectfully submitted,

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(viii) CLAIMS APPENDIX

1. A method of rotating data in a plurality of processing elements, comprising:

a plurality of shifting operations performed by a plurality of processing elements connected in an array; and

a plurality of storing operations performed by said plurality of processing elements, said shifting and storing operations coordinated to enable a three shears operation to be performed on the data, and wherein said plurality of storing operations is responsive to each processing element's position in said array.

2. The method of claim 1 wherein said plurality of storing operations are responsive to initial counts which are either loaded into at least certain of said processing elements or calculated locally based on the processing element's location.

3. The method of claim 2 additionally comprising maintaining a current count in each processing element for each initial count, said current counts being responsive to said initial counts and the number of data shifts performed.

4. The method of claim 3 wherein said maintaining current counts includes altering said initial counts at programmable intervals by a programmable amount.

5. The method of claim 4 wherein said initial counts are decremented in response to a shifting of data to produce said current counts.

6. The method of claim 5 wherein a storing operation is performed when a current count in a processing element is non-positive.

7. The method of claim 1 additionally comprising selecting which processing elements are active in response to a row select signal and a column select signal.

8. A method of rotating data in a plurality of processing elements, comprising:

a first shifting of a first plurality of data in a first direction;

a first storing of data by a first plurality of said processing elements in response to said first shifting and the positions of said first plurality of processing elements;

a second shifting of a second plurality of data in a second direction perpendicular to said first direction;

a second storing of data by a second plurality of processing elements in response to said second shifting and the positions of said second plurality of processing elements;

a third shifting of a third plurality of data in a third direction opposite to said first direction; and

a third storing of data by a third plurality of processing elements in response to said third shifting and the positions of said third plurality of processing elements.

9. The method of claim 8 wherein said first, second and third storing of data are responsive to initial counts which are either loaded into at least certain of said processing elements or calculated locally based on the processing element's location.

10. The method of claim 9 additionally comprising maintaining a current count in each processing element for each initial count, said current counts being responsive to said initial counts and the number of data shifts performed.

11. The method of claim 10 wherein said maintaining current counts includes altering said initial counts at programmable intervals by a programmable amount.

12. The method of claim 11 wherein said initial counts are decremented in response to a shifting of data to produce said current counts.

13. The method of claim 12 wherein a storing operation is performed when a current count in a processing element is non-positive.

14. The method of claim 8 wherein said first, second and third plurality of processing elements are selected using a row select signal and a column select signal.

15. A method of rotating data in a plurality of processing elements, comprising:

a first plurality of shifting and storing operations coordinated to enable a first shear operation to be performed in a first direction in a plurality of processing elements arranged in an array;

a second plurality of shifting and storing operations coordinated to enable a second shear operation to be performed in a second direction perpendicular to said first direction in said array; and

a third plurality of shifting and storing operations coordinated to enable a third shear operation to be performed in a third direction opposite to said first direction in said array, and wherein said pluralities of storing operations are responsive to each processing element's position in said array.

16. The method of claim 15 wherein said pluralities of storing operations are responsive to initial counts which are either loaded into at least certain of said processing elements or calculated locally based on the processing element's location.

17. The method of claim 16 additionally comprising maintaining a current count in each processing element for each initial count, said current counts being responsive to said initial counts and the number of data shifts performed.

18. The method of claim 17 wherein said maintaining current counts includes altering said initial counts at programmable intervals by a programmable amount.

19. The method of claim 18 wherein said initial counts are decremented in response to a shifting of data to produce said current counts.

20. The method of claim 19 wherein a storing operation is performed when a current count in a processing element is non-positive.

21. The method of claim 15 additionally comprising selecting which processing elements are active in response to a row select signal and a column select signal.

22. A method of rotating data in a plurality of processing elements, comprising:

a first shifting of a first plurality of data in a first pair of directions;

a first storing of data by a first plurality of said processing elements in response to said first shifting and the positions of said first plurality of processing elements;

a second shifting of a second plurality of data in a second pair of directions perpendicular to said first pair of directions;

a second storing of data by a second plurality of processing elements in response to said second shifting and the positions of said second plurality of processing elements;

a third shifting of a third plurality of data in said first pair of directions; and

a third storing of data by a third plurality of processing elements in response to said third shifting and the positions of said third plurality of processing elements.

23. The method of claim 22 wherein said first, second and third storing of data are responsive to initial counts which are either loaded into at least certain of said processing elements or calculated locally based on the processing element's location.

24. The method of claim 23 additionally comprising maintaining a current count in each processing element for each initial count, said current counts being responsive to said initial counts and the number of data shifts performed.

25. The method of claim 24 wherein said maintaining current counts includes altering said initial counts at programmable intervals by a programmable amount.

26. The method of claim 25 wherein said initial counts are decremented in response to a shifting of data to produce said current counts.

27. The method of claim 26 wherein a storing operation is performed when a current count in a processing element is non-positive.

28. The method of claim 22 wherein said first, second and third plurality of processing elements are selected using a row select signal and a column select signal.

29. A method of rotating data in a plurality of processing elements, comprising:

a first plurality of shifting and storing operations coordinated to enable a first shear operation to be performed in a first pair of directions in a plurality of processing elements arranged in an array;

a second plurality of shifting and storing operations coordinated to enable a second shear operation to be performed in a second pair of directions perpendicular to said first pair of directions in said array; and

a third plurality of shifting and storing operations coordinated to enable a third shear operation to be performed in said first pair of directions, and wherein said pluralities of storing operations are responsive to each element's position in said array.

30. The method of claim 29 wherein said pluralities of storing operations are responsive to initial counts which are either loaded into at least certain of said processing elements or calculated locally based on the processing element's location.

31. The method of claim 30 additionally comprising maintaining a current count in each processing element for each initial count, said current counts being responsive to said initial counts and the number of data shifts performed.

32. The method of claim 31 wherein said maintaining current counts includes altering said initial counts at programmable intervals by a programmable amount.

33. The method of claim 32 wherein said initial counts are decremented in response to a shifting of data to produce said current counts.

34. The method of claim 33 wherein a storing operation is performed when a current count in a processing element is non-positive.

35. The method of claim 29 additionally comprising selecting which processing elements are active in response to a row select signal and a column select signal.

36. A computer readable memory device carrying a set of instructions which, when executed, perform a method comprising:

a plurality of shifting operations using a plurality of processing elements connected in an array; and

a plurality of storing operations using said plurality of processing elements, said shifting and storing operations coordinated to enable a three shears operation to be performed on the data, and wherein said plurality of storing operations is responsive to each processing element's position in said array.

(ix) EVIDENCE APPENDIX

None.

(x) RELATED PROCEEDINGS APPENDIX

None.